Deriving the Directionality Parameter in OT-LFG*

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1 Introduction

Recent work in Optimality Theoretic Syntax (Samek-Lodovici 1996, Grimshaw 1997, Costa 1998, Sells 2001) successfully models positioning of syntactic elements that target a privileged position in a clause, such as topics, sentential adverbs, operators, and core syntactic dependents like the subject, by extending the mechanism of Generalized Alignment developed in OT phonology (McCarthy and Prince 1993) to the domain of clausal syntax. By allowing only left-alignment, Sells' (1999a,b, 2001) work takes a pioneering step towards recasting Kayne's (1994) insightful observation that phrase structure is fundamentally antisymmetric: there is a universal preference for the left-edge of the clause, so that the (unmarked) structure is predominantly right-branching.

Restricting alignment to the left-edge of a clause as in earlier proposals imposes serious limitations on the kinds of syntactic positioning and constructions we can explain within the constraint-based, output-oriented model of grammar. For example, there is a major class of constituents that exhibit affinity with the head (which I call 'head-attracted' constituents as opposed to 'edge-attracted' constituents like topics, operators, etc. mentioned above), and structural position of such constituents is dependent on the directionality of heads: head-initial languages typically place the head of the relative clause before the modifying clauses, negation before the verb, and objects and focus after the verb; head-final languages, on the other hand, typically place the head of the relative clauses after the modifying clause, negation after the verb, and object and focus before the verb. In some of these cases, the opposite patterns are quite rare or non-existent. These predictable patterns of syntactic positioning therefore deserve a principled explanation.

Focusing on a typology of sentential negation, my goal in this paper is to show how the distribution of head-attracted constituents like negation can be explained by a set of well-grounded universal constraints independently proposed to derive the typology of clause structure and the head directionality parameter.

2 Expression of Sentential Negation

According to Dahl (1979), negation is most commonly expressed in one of three forms. First, negation can be expressed as an inflectional morpheme, as illustrated in (1)–(3). (1) and (2) are examples from SOV languages, and the negative morpheme is expressed as a suffix. (3) is an SVO language, and the negative morpheme is prefixal.

(1) Turkish (SOV): suffix

John elmalar-i ser-**me**-di-∅
John apples-ACC like-NEG-PAST3SG
'John didn't like apples.'

(2) Japanese (SOV): suffix

Taroo-wa asagohan-o tabe-**na**-katta.
Taroo-TOP breakfast-ACC eat-NEG-PAST
'Taro didn't eat breakfast.'

(3) Bantu—Kinyarwanda (SVO): prefix

Sií-n-zi igihe á-záa-garuk-(ir)-a.
NEG-I-know time he-FUT-REL-return-APPL-ASP
'I don't know when he will return.' (Kimenyi 1980:69)

Second, negation can also be expressed as an invariant (morphologically uninflected) negative particle, as illustrated in (4)–(8) from a variety of languages that represent different word order types.

(4) English (SVO): negative particle

John does **not** speak German.

(5) French (SVO): negative particle

Jean (n') est **pas** venu.
Jean *ne* is not come
'Jean did not come.' (Haegeman 1995:229)

(6) German (SOV): negative particle

Warum gefiel unsere Lösung dem Peter **nicht**?
why pleased our solution Peter not
'Why did our solution not please Peter?' (Haegeman 1995:168)

(7) Swedish (SVO): negative particle

Jan köpte **inte** boken.
Jan bought NEG books
'John didn't buy books.' (Holmberg and Platzack 1988)

(8) Malagasy (VOS): negative particle

Tsy manasa lamba mihitsy ve Rakoto?
NEG wash clothes at.all Q Rakoto
'Does Rakoto not wash clothes at all?' (Rackowski and Travis 2000)

Another way to express negation is to use a negative auxiliary as shown in (9)–(10). Korean shows a postverbal negative auxiliary, and Finnish, preverbal. In these languages, the negative auxiliary and the main verb are morphologically independent words, forming a verbal complex.

(9) Korean (SOV): negative auxiliary

Na-nun phyenci-lul ssu-ci **anh-ass-ta**.
I-TOP letter-ACC write-COMP NEG-PAST-DECL
'I didn't write a letter.' (Kim 2000:2)

(10) Finnish (SOV): negative auxiliary

Minä **e-n** puhu-isi
I-NOM NEG-1SG speak-COND
'I would not speak.' (Mitchell 1991)

Several observations regarding both the form and placement of negation are noted. First, Dahl (1979) observes that negation is often attracted to the verb. Moreover, as illustrated in the Malagasy example in (8), verb-initial languages has a strong tendency to place NEG preverbally in sentence-initial position (Dahl 1979, Payne 1985, Dryer 1988).

Second, Dahl also notes that negative morphemes appearing immediately after the main verb (either as a suffix to the verb stem or as an independent word) are typically inflected (e.g. for tense, mood). This is illustrated by the examples from Turkish and Japanese in (1)–(2). On the other hand, negative morphemes appearing in (immediately) preverbal position tend to be uninflected, as exemplified by the variety of languages in (4)–(8).

Thirdly, Dryer (1988) observes that SVO languages most commonly (47 out of 67 languages in Dryer's typological survey) place NEG preverbally. On the other hand, SOV languages commonly place NEG postverbally (64 out of 117 languages in Dryer (1998)). It is also noted, however, that there are also a fair number of SOV languages (39 out of 117) in which negation is expressed preverbally. Hindi and Korean in (11) and (12), whose basic word order is SOV, exemplify this last pattern. In short, the placement of negation tends to be quite uniform among verb-initial languages, but among SVO and SOV languages, it is much more variable.

(11) Hindi (SOV) preverbal negation

anjum haar **nahĩ̃** banaa rah-ii hai
Anjum.F.NOM necklace.M.NOM NEG make STAT-PERF.F.SG is
'Anjum is not making a necklace.' (Butt 1994:79)

(12) Korean (SOV) preverbal negation

John-un ppang-ul **an** mek-ess-ta.
John-TOP bread-ACC NEG eat-PAST-DECL
'John didn't eat the bread.' (Kim 2000:1)

Of course not only is the exact structural position of negation variable in these language types, but forms of negation also vary (elaborated below). An obvious question is whether the cross-linguistic variation in form and position of negation can be systematically derived by a set of universal constraints on clause structure, by relating the distribution of negation with other elements in the clause. In what follows, I argue that it can and should be, and show how the question can be answered straightforwardly

from the OT-LFG perspective.

The above data and the typological generalizations noted above are summarized in the table in (13). Going from the left to right in the columns, we have the languages considered in the analysis to follow, which presumably represent predominant language types with respect to the syntax of negation, syntactic category of the negative element, its position, the position of the main verb, and presence/absence of a functional category.

(13)

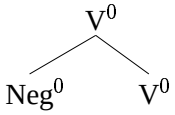
	Languages	NEG category	NEG position	V pos.	F?
I.	Japanese (SOV)	suffix	V^0	V	no
II.	Bantu (SVO)	prefix	V^0	V	C
III.	Korean *an* (SOV)	NEG^0	left-adjoins to V^0	V	no
IV.	Korean *anh-ta* (SOV)	V^0 (postverbal)	form V^0 w/ LexV^0	V	no
V.	English (SVO)	particle	IP domain	V	I,C
VI.	German (SOV)	particle	VP domain	V2	C
VII.	Swedish (SVO)	particle	IP domain	V2	I,C

The table indicates that one language type represented by Japanese and Turkish, referred to as Type I here, has a negative suffix morphologically attached to the verb stem. Importantly, this language type lacks any evidence of a functional category. Cho and Sells (1995) and Sells (1995), for example, present morphophonological and morphosyntactic evidence for the lack of functional categories (I, C, or D) in Japanese and Korean. The form of negation and presence/absence of a functional category exhibit an interesting correlation, and that will become clearer through the analysis.

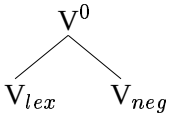
The second language type, referred to as Type II hereafter, is represented by Bantu languages like Kinyarwanda illustrated earlier in (3). This language type has a negative prefix bound to V^0. The verb is in V in most clause types.[1] As for the presence/absence of functional categories, Bresnan and Mchombo (1987), for example, argue convincingly that the Bantu language Chicheŵa lacks evidence for I^0. Other Bantu languages such as Kirundi, Kinyarwanda, and Swahili also show no evidence for I (cf. Morimoto 2000).

As illustrated earlier Korean displays two types of negation. One type (Type III in the table) is the preverbal negative particle *an* (cf. (12)), and the other, the postverbal negative auxiliary (cf. (9)). The preverbal particle *an* is analyzed as Neg^0 which is adjoined to V^0 to form a verbal complex V^0, as shown in (14a); the postverbal negative auxiliary (V_{neg}) forms a V^0 with the main verb (V_{lex}), as shown in (14b) (Sells 1999a). Like Japanese, Korean lacks any evidence of functional categories I, C, and D (cf. Cho and Sells 1995, Sells 1995, Choi 1999).

(14) a.



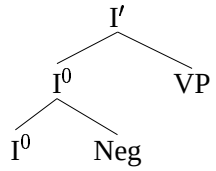
b.



English, German, and Swedish, referred to in the table as Types V, VI, and VII respectively, have a morphologically invariant negative particle, but each exhibits a different pattern in terms of the positioning of the negative element. In English, sentential negation is in the domain of IP. Bresnan (2001b), for example, analyzes the English negative particle to be adjoined to I^0, as shown in (15).

[1] It is argued that in a subset of Bantu languages such as Dzamba, Swahili, and Kilega that display so-called "subject inversion" in relative clauses, the verb in the relative clause appears in C. See Morimoto (2001) and references on earlier work cited therein.

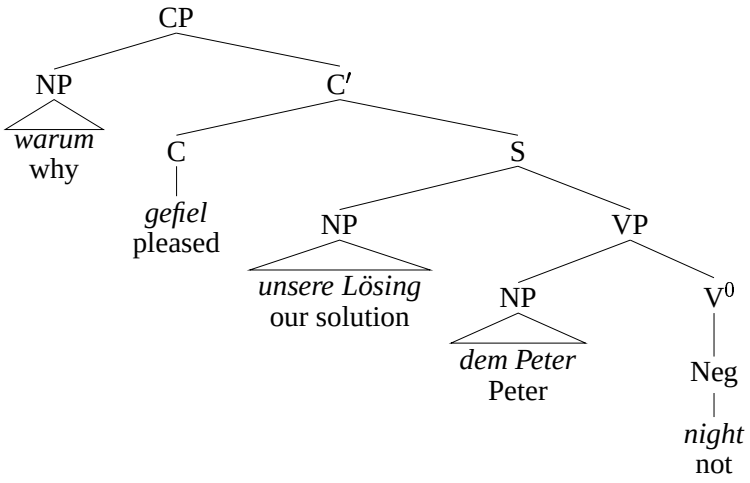
(15) a. Type V. English (Bresnan 2001b)



In German, sentential negation is apparently in the domain of VP. For example, the earlier example in (6), repeated here in (16a), can be assigned a structure like that in (16b). As argued most recently by Choi (1999) and Berman (2000), in German, phrasal elements in sentences like that in (6) are organized within the exocentric category S dominated by CP. The finite verb occupies C satisfying the verb-second requirement. Under CP we have a head-final structure: the subject is under S, and the object inside VP. Given the basic clause structure in German established in the LFG earlier work above, the negative particle naturally falls within VP, presumably adjoined to V^0 as shown.

(16) a. Warum gefiel unsere Lösung dem Peter **nicht**?
why pleased our solution Peter not
'Why did our solution not please Peter?' (Haegeman 1995:168)

b.

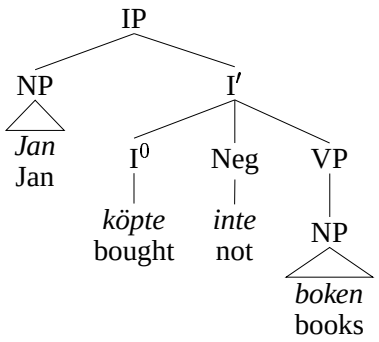


In Swedish, negation is argued to be in the IP domain. Sells (2000) presents empirical evidence specifically showing that Swedish negation cannot be inside VP. The earlier example in (7), repeated here in (17a), thus can be assigned a structure like that in (17b). Swedish exhibits verb-second (V2) in main clauses, so the finite verb in (17a) occupies I, and the subject is in SpecIP.[2]

[2]English negation could perhaps be analyzed as having a structure like that in Swedish in (17b). For simplicity, in my analysis I will treat English and Swedish negation as having the structure in (17b).

(17) a. Jan köpte **inte** boken.
Jan bought NEG books
'John didn't buy books.'

b.



An additional example from Swedish in (18) more clearly shows that negation can be placed anywhere within the IP domain but cannot be within VP, as pointed out by Sells (2000, ex.(6b)).

(18)	att	(inte)	Johan	(inte)	[$_{vp}$	gillar	(*inte)	prinsesstårta]	
	that	(not)	Johan	(not)	[$_{vp}$	likes	(*not)	princess cake]	(Holmberg 1993)

Based on the distribution of the negative particle in these languages, we might state more generally that languages choose between the domain of a lexical projection (VP) or that of a functional projection (IP) for the position of negation. In what follows, I provide an OT-LFG analysis to suggest how the cross-linguistic inventories in the form and position of negation can be viewed as a result of the systematic interaction of constraints on clausal skeleton, head-positioning, and those on structural economy.

3 Clausal Syntax in OT-LFG

Due to space limitations, I will omit much of the discussion on the nature of the INPUT and GEN by now standardly assumed in OT-LFG work. For detailed discussion, I refer the reader to Kuhn (2001) and Sells (2001a,b). In the present discussion, I concentrate on motivating the crucial constraints and deriving the typology of negation discussed in the previous section.

Particularly crucial to the analysis is the use of the constraint family of Generalized Alignment (McCarthy and Prince 1993). The core idea of Generalized Alignment has been extended to the domain of syntax to account for placement of clausal elements (e.g. heads and complements). Furthermore it has been proposed that there is preference for clausal elements to align to the left edge, thereby yielding clause structure that is predominantly right-branching rather than left-branching (cf. Sells 2001b, Grimshaw 2001).

This "leftness" tendency is essentially the observation that led Kayne (1994) to develop his theory of the antisymmetry of phrase structure. Kayne's key proposal that an asymmetric dominance relation (i.e. c-command) invariably maps onto linear precedence (referred to as the Linear Correspondence Axiom) makes a number of important typological predictions. In order for the theory to work, however, Kayne must treat a set of universal tendencies as absolute universals, or hard constraints, and derive more marked or non-canonical structures by movement of relevant syntactic elements. Motivating a series of movement operations required by the theory is often difficult, if not empirically unfounded.

Recent developments in OT syntax using the formal mechanism of Generalized Alignment, particularly the work of Sells (2001b) and Grimshaw (2001), are attempts to recast Kayne's insights from the non-derivational perspective. OT's capacity to explain "soft" generalizations like linguistic universals by exploiting violability of constraints is well-supported in other areas of grammar (e.g. Sells (2001a)

and earlier work cited therein), and has also been shown to be a promising framework for explaining phrase structure universals and cross-linguistic variation. The analysis presented in this section builds on the earlier OT-LFG approach to clause structure and further refines the model by proposing a additional formal mechanism that effectively derives directionality parameters.

Clause Structure Constraints

Two alignment constraints have been proposed on clausal skeleton and head directionality (taken from Sells 2001b): left-alignment of heads ('Head-Left') is applied within an immediate projection of the head. Importantly, there is no Head-Right constraint. This essentially recaptures Kayne's proposal about the universal order of head-complement structure. Here, this is a soft constraint on representation, and obviously it is violated more severely by head-final structure. The only right-alignment constraint admitted in the present approach is Spine-R(ight): this requires that any head (e.g. V) and its extended heads (V′, VP, I, I′, IP), or co-heads (= spine), be final in each of their local subtree (hence 'Spine-Right'), preferring a fully right-headed structure.

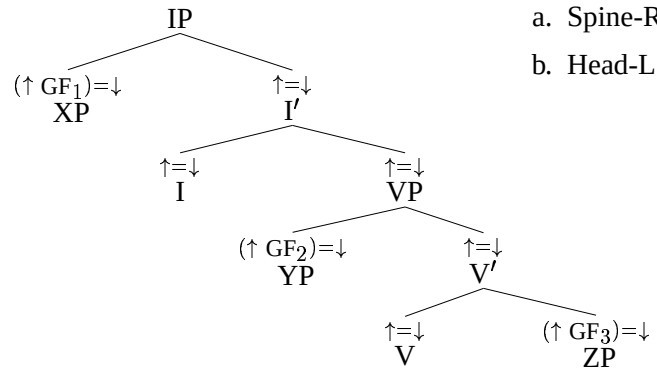
(19) Head positioning constraints

a. Head-L(eft): X^0 is left in its immediate constituent.

b. Spine-R(ight): A co-head aligns right in its immediate constituent.

To illustrate how these constraints figure in OT-LFG grammar, let us consider a schematic SIVO structure in (20).[3]

(20) SIVO structure



a. Spine-R violations: 2 (I and V).

b. Head-L violation: 0.

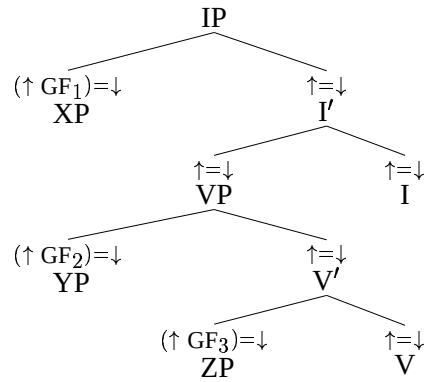
Starting from the bottom, within the immediate projection of V′, there is 1 Spine-R violation at V, as this node, annotated ↑ = ↓ is a co-head but does not align right within its immediate projection. V is also a c-structure X^0 head, and aligns left in its local subtree, so this respects the Head-L constraint. Second, going up one level in the structure within the subtree dominated by VP, there is no violation of Spine-R or Head-L: the co-head V′ aligns right (respecting Spine-R), and there is no X^0 at this level. Within the next higher subtree, I and VP are co-heads. The configuration given here thus violates Spine-R once for I but there is no Head-L violation. Note in passing that if the head is rightmost, and the VP co-head is leftmost in the structure, then this configuration would violate both Spine-R (degree of 1) and Head-L.

[3]The structure in (20) and the subsequent trees representing different word order types are originally discussed in Sells (2001).

Consequently, having functional projections is more preferable in head-initial languages than in head-final languages. In sum, in this structure, there are 2 Spine-R violations and no Head-L violation, as indicated in (20). Thus, in order to yield this structure as optimal, Spine-R must be ranked lower than Head-L.

Sells' proposal on the derivation of a clausal skeleton makes a number of important typological predictions, particularly when we contrast head-initial and head-final structures. For example, let us assume the basic clause structure for a head-final language to be the mirror-image of the SIVO structure in (20) with respect to head positioning:

(21) SOVI structure



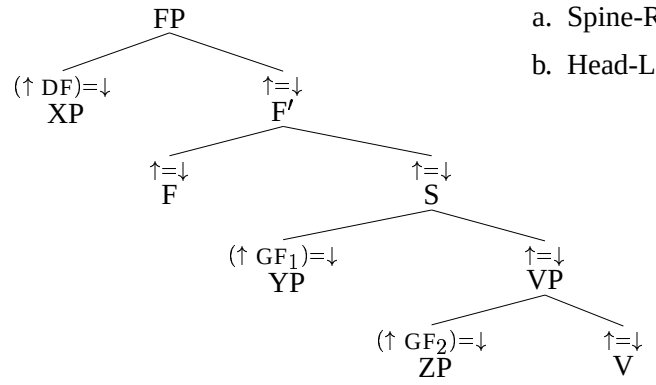
a. Spine-R violation: 1 (VP).

b. Head-L violations: 2 (I and V).

The structure in (21) violates Spine-R once at VP (a co-head) and Head-L twice, at I and V. More generally, whenever the structure contains a functional head (F^0), which is also a co-head (annotated ↑ = ↓), the sister node will always be a co-head also; therefore whether F^0 is left or right, this local structure will violate Spine-R once. Having F^0 in a head-final structure also means Head-L violations will be more severe.

Is there a more optimal head-final structure than (21) that GEN can generate? Note that in addition to the endocentric XPs, OT-LFG also allows the exocentric category S (Bresnan 2001b). If we posit a structure like that given in (22) where there is a single functional head above S, violation of high-ranking Spine-R is fewer. This structure is observed in German, where SpecFP is reserved for a discourse function (e.g. TOPIC).

(22) SIOV structure (e.g. German nonsubject-initial clause)



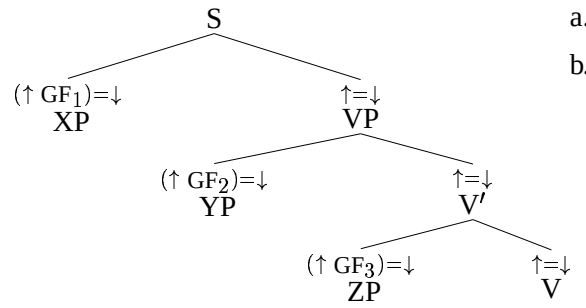
a. Spine-R violation: 1 (I).

b. Head-L violation: 1 (V).

Importantly, unless the presence of a functional projection is required (e.g. by V2, as observed in

German), the most optimal structure in head-final languages would be one in which the root node has the exocentric organization (S) and has no functional head above it, as shown in (23). In this structure, each co-head (ones annotated ↑ = ↓) aligns right in its local subtree. The degree of Spine-R violation is therefore 0. The structure has one lexical head (V) at the bottom of the structure, aligning right. This incurs 1 violation of Head-L.

(23) SOV structure



a. Spine-R violation: 0.

b. Head-L violation: 1 (V).

Indeed as briefly noted earlier, it is generally the case that some head-final languages lack lexically independent functional heads. That is, tense/aspect and complementizer are typically morphological affixes on the verb; see for example, Cho and Sells (1995), Sells (1995) for Korean and Japanese. Kayne's theory of the antisymmetry of phrase structure predicts that there is no V-I-C rightward movement. Instead, V universally moves to I and to C leftward; in head-final languages, IP complement of C moves leftward to yield the verb-final structure. The OT constraints on clausal skeleton derive exactly this asymmetry: Head-L ≫ Spine-R optimally yields a head-initial language; the presence of functional projections (at least one violation of Spine-R) would be tolerated. Spine-R ≫ Head-L optimally yields a head-final language; Spine-R being high-ranked, the presence of any functional projection will be dispreferred, as there is an alternative in head-final languages of having bound inflectional elements morphologically attached to a verb. This view of phrase structure is also suggested and formally implemented by Haider (1997a, 1997b) in a different framework.

As Sells (2001) points out, Spine-R also prefers specifiers and adjunctions to be leftward: specifier is sister to a bar-level category, necessarily a co-head, and the node sister to an adjoined element will always be a co-head also, whether adjunction takes place at XP, X′, or X^0. No other constraints or movements need to be postulated to capture this 'leftness' tendency observed and modeled by Kayne.[4]

The alignment constraint in (24) prefers subject to be the leftmost in a clause. More precisely, the constraint requires alignment of the c-structure node that maps to the f-structure of SUBJ and the c-structure that maps to the immediately outer f-structure nucleus. The details of how this is achieved are omitted here due to space limitations.

(24) SUBJ-L(eft): Subject aligns left in the clause.

Constraints on Adjacency

While earlier proposals on syntactic positioning based on the idea of alignment (here strictly interpreted as aligning identical edges) have been successful in capturing some typological generalizations about word order, headedness of phrases, and realization of grammatical information that correlates

[4]For other word order types not illustrated here, see Sells (2001); also Morimoto (2000b, chapter 3).

with clausal organization, it is not clear if alignment alone can explain all types of syntactic positioning. There is a rather wide range of syntactic elements that prefer adjacency with their respective heads (referred to as 'head-attracted' constituents in section 1): negation, focus, and (XP/X^0) adverbs typically appear near the verbal head; a relative pronoun and possessor prefer adjacency with their respective nominal head. Moreover, positioning of these constituents correlates with head directionality: verb-initial and verb-final languages often (though not always) exhibit the mirror image with respect to positioning of these constituents. In this respect, these head-attracted constituents thus deserve a unified treatment.

The formal mechanism proposed in the present work, referred to as *abutment*, is modeled on Generalized Alignment, and is intended to derive directional parameters. Abutment is alignment of *opposite*, rather than identical, edges. According to (25), there exists some category C_1 (e.g. focus, adverb, relative pronoun) and C_2 (e.g. V-head, N-head); abutment is satisfied if, for example, the left-edge of C_1 is adjacent to the right-edge of C_2. C_1 can be a c-structure node, or a f-structure attribute which maps onto a particular c-structure node. On the other hand, C_2 is always a c-structure head. Crucially, the constraint does not specify particular edges of the elements; the only requirement is that two edges be opposite.

(25) **Abutment**

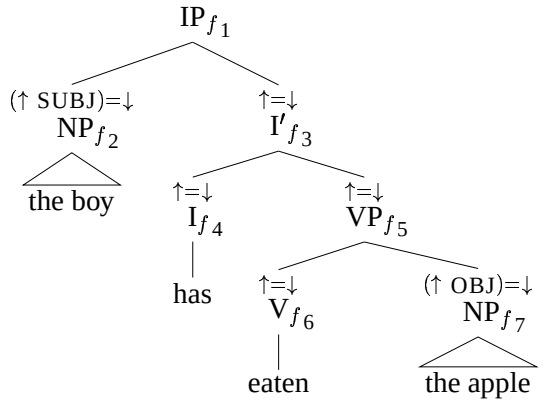
Abut(Cat_1,$Edge_1$, Cat_2,$Edge_2$) = $_{def}$
$\forall$ Cat_1 $\exists$ Cat_2 such that $Edge_1$ of Cat_1 shares $Edge_2$ of Cat_2.

Where $Cat_1 \in$ F-Cat $\cup$ C-Cat, $Cat_2 \in$ C-Cat
$Edge_1$, $Edge_2 \in \{$Right, Left$\}$ & $Edge_1 \neq Edge_2$.

Constraints instantiated by Abutment in (25) are abbreviated as "Abut-C_1(C_2)". To illustrate how Abutment works more concretely, let us consider OBJ abutment in (26) and the simple transitive sentence in (27); here F is instantiated by OBJ (f_7), and C by a verbal head (V-HD). C′ will be the NP that corresponds to OBJ. According to abutment defined in (25), the verb-object configuration in (27) satisfies the constraint (26): there exists a node NP_{f_7} (= C′ in (25)) which maps to the f-structure of of OBJ (= F in (25)), and the left edge of that node meets the right edge of V (= C in (25)).

(26) Abut-OBJ(V-HD): Abut E_1 of OBJ with E_2 of V-HD.

(27) $[_{IP}\ [_{NP}$ The boy$]\ [_{I'}$ has $[_{VP}$ eaten an apple$]]]$



$$f_{1,3,5,6}: \begin{bmatrix} \text{PRED} & \text{'eat <}(f_1\ \text{SUBJ})\ (f_1\ \text{OBJ})\text{>'} \\ \text{SUBJ} & f_2: \begin{bmatrix} \text{PRED} & \text{'boy'} \end{bmatrix} \\ \text{OBJ} & f_7: \begin{bmatrix} \text{PRED} & \text{'apple'} \end{bmatrix} \\ \text{TENSE} & \text{PRES} \\ \text{ASP} & \text{PERF} \end{bmatrix}$$

Now consider the constraint on placement of negation in (28a). Here C_1 (Neg^0) and C_2 are both (part of) c-structure nodes. The constraint is satisfied as long as negation, however it is realized, is adjacent to the main verb as shown in (28b).

(28) a. Abut-NEG(V-HD): Abut E_1 of NEG with E_2 of V-HD.

b.

Neg Form	Before V	After V	Eval
Affixal	Neg-V	V-Neg	satisfied
	Neg-X-V	V-X-Neg	violated
Particle	V Neg	Neg V	satisfied
	V ... Neg	Neg ... V	violated
Auxiliary	V_{lex} V_{neg}	V_{neg} V_{lex}	satisfied
	V_{lex} ... V_{neg}	V_{neg} ... V_{lex}	violated

Constraints on X^0 Elements

Additional constraints needed to model the typology of negation discussed above include those on head positioning, given in (29). In English, *Lex-in-F is high-ranked (cf. Bresnan 2000b, Sells 2001), whereas V2 plays little role. In V2 languages, *Lex-in-F ranks below V2 so that a lexical head (inflected main verb) can occupy V2 position to respect the high-ranking V2 constraint.

(29) a. "V2": Satisfied by an inflected verbal element in the second position F^0. (cf. Sells 2001)

b. *Lex-in-F: Avoid lexical head in functional head position.

The constraint in (30) articulates the intuition that negation is associated with Infl (or F^0). At a superficial level for example, in derivational frameworks negation is often analyzed as the head of the function projection NegP. Although the data presented earlier revealed that languages apparently choose between the FP and LP domain for the placement of negation, the analysis presented below will show that negation in the LP domain is forced by other constraints, including a high-ranking constraint on structural economy (discussed below). In other words, if nothing else forces negation to be elsewhere, it will appear in the FP domain (under F' or adjoined to F^0).

(30) Neg-in-FP: Negation must in the FP domain.

Constraints on Economy and Markedness

Two constraints are introduced below on structural economy and morphological markedness. The economy constraint penalizes every X^0 and its projection. The underlying premise is that economical structure is preferred, and the most optimal output would be one with no structure at all. However, that would incur massive violation of faithfulness, as the input (semantic and syntactic) information would not be faithfully represented in the output. In other words, structure is driven by the need to satisfy faithfulness constraints. Economy constraints proposed in earlier work include $*X^0$ (Sells 1998) and Don'tProj (Bresnan 2000b) which penalizes empty nodes. ECONOMY in (31) is taken to be a more general constraint against any structure.

The constraint *Affix is a constraint against having a morphologically marked structure. The assumption is that bound forms are more marked than analytic forms. The relative markedness of morphologically bound forms is more clearly discernible in other areas of grammar such as pronominal systems. Bresnan's (2000a, 2001a) work on typological variation in pronominal systems reveals that there are languages with only free pronouns, as well as those with both free and reduced (bound) pronominal forms, but there are no languages with only reduced pronominals—displaying a classic markedness asymmetry. It is also well-known that newly created contact languages as a result of massive reduction and simplification of structures at all levels of grammar often exhibit recurring universal properties, such as a smaller inventory of consonant and vowel systems, preference for CV structure, simplified morphology, absence of complex sentences, and analytic syntax (Foley 1988, Thomason and Kaufmann 1988, Holm 1989, Bakker 1995). Preference of analytic forms over synthetic forms reported in the literature on pidgin languages (such as those cited above) is thus one such unmarked property (also see Bresnan 1998 for a discussion of these generalizations in the context of OT-LFG formalization).

(31) a. ECONOMY: Economical structure is preferred (violated by every X^0 and XP).

b. *AFFIX: Avoid affixes. (Analytic forms are preferred over synthetic forms.)

Below is a summary of the constraints discussed above. As indicated, some of the constraints that are not crucial in the analysis will be omitted from the tableaux for the sake of simplicity and compactness. They are nonetheless assumed to exist, and in the analysis presented below, those constraints will be satisfied by appropriate candidates.

(32) Summary of Constraints

a.	a.	Head-L	(19a)	f.	ECONOMY	(31a)	
	b.	Spine-R	(19b)	g.	*AFFIX	(31b)	
	c.	"V2"	(29a)	h.	Abut-OBJ(V-HD)	(26)	omitted from tableaux
	d.	Neg-in-FP	(30)	i.	SUBJ-L	(24)	omitted from tableaux
	e.	Abut-NEG(V-HD)	(28)	j.	*Lex-in-F	(29b)	omitted from tableaux

4 Deriving a Typology of Negation

Having established the constraints necessary to derive the basic clause structure and placement of negation, we now turn to the discussion of exactly how these constraints derive the cross-linguistic variation in the form and placement of negation. The languages considered here are again listed below.

(33) Candidates

I.	Japanese (SOV)	V.	English (SVO)
I I.	Bantu (SVO)	VI.	German (SOV, V2)
III.	Korean preverbal NEG (SOV)	VII.	Swedish (SVO, V2)
IV.	Korean postverbal NEG		

The rankings in (34) show abstractly which constraints play a crucial role in each language. I will discuss these rankings together with the tableaux presented below. The first to note in the overall

analysis is that as mentioned earlier head directionality is determined by interaction of two constraints on clausal skeleton, Head-L and Spine-R: head-final structure in languages like Japanese is ensured by ranking Spine-R (b) above Head-L (a); head-initial structure in languages like Bantu and English is derive by the reverse ranking. In some languages (e.g. V2 languages such as German and Swedish) these constraints on clausal skeleton exhibit an interesting interaction with other constraints, particularly those on head positioning. In others (Types I–IV), such interaction is not obvious. The ranking of these constraints relative to others are therefore not crucial in the analysis for those languages.

(34) Constraint Rankings

a. Head-L b. Spine-R c. "V2" d. Neg-in-FP
e. Abut-NEG(V-HD) f. ECONOMY g. *AFFIX

I. b ≫ a ≫ f ≫ e ≫ d ≫ g ≫ c
II. a ≫ b ≫ f ≫ e ≫ d ≫ g ≫ c
III & IV. b ≫ a ≫ h ≫ f ≫ g ≫ e ≫ c
V. d ≫ a ≫ e ≫ b ≫ g ≫ f ≫ c
VI. c ≫ g ≫ f ≫ b ≫ a ≫ e ≫ d
VII. c ≫ d ≫ a ≫ b ≫ f ≫ e ≫ g

Focusing now on the rest of the constraints, in Types I and II, ECONOMY is a high-ranking constraint and ranks above *Affix: this ranking prefers a synthetic form of negation over an analytic form. Recall that clauses in these languages are taken to be organized around the exocentric category S, due to the lack of evidence for Infl (cf. Sells 1995 for Japanese; Bresnan and Mchombo 1987, Morimoto 2000 for Bantu). Given the preference for S over IP, Neg-in-FP and V2 are presumably low-ranked.[5] Reversing the ranking of Spine-R and Head-L (i.e. Head-L ≫ Spine-R), we get Type II languages.

(35) Type I: Japanese, Turkish

		Spine-R	Head-L	ECONOMY	ABUT-NEG	Neg-in-FP	*AFFIX	"V2"
I. ☞	$[_S$ NP$_{su}$ $[_{VP}$ NP$_{oj}$ V-**NEG**]]	0	1	7		*	*	
II.	$[_S$ NP$_{su}$ $[_{VP}$ **NEG**-V NP$_{oj}$]]	1!	0	7		*	*	
III.	$[_S$ NP$_{su}$ $[_{VP}$ $[_{V^0}$ **NEG**^{0} V^0] NP$_{oj}$]]	0	1	8!		*		
IV.	$[_S$ NP$_{su}$ $[_{VP}$ NP$_{oj}$ $[_{V^0}$ V^0-COMP **NegV**^{0}]]]	0	1	8!		*		
V.	$[_{FP}$ NP$_{su}$ $[_{F'}$ F^0 **NEG** $[_{VP}$ V NP$_{oj}$]]]	2!	0	8				
VI.	$[_{FP}$ NP$_{su}$ $[_{F'}$ F^0 $[_{VP}$ NP$_{oj}$ $[_{V'}$ **NEG** V]]]]	1!	1	8		*		
VII.	$[_{FP}$ NP$_{su}$ $[_{F'}$ F^0 **NEG** $[_{VP}$ V NP$_{oj}$]]]	2!	0	8				

The ranking for Types III and IV yields both the structure with a preverbal negative particle and the one with a postverbal negative auxiliary in Korean. *Affix crucially ranks above ECONOMY, favoring

[5]Constraints that determine the choice between S and IP are omitted in the present discussion. A previously proposed constraint like *S-node (Morimoto 2000), for example, disfavors the exocentric node S, whereas OB-HD(FP) ("FP must have an overt head"), if ranked above *S-node, ensures the root node will be S in the absence of the overt head F^0.

an analytic form over a synthetic form. Like Japanese, Korean lacks evidence for Infl (cf. Cho and Sells 1995), and is thus taken to make use of the exocentric category S. The constraints Neg-in-FP and "V2" therefore are ranked low.

(36) Type III & IV: Korean

		Spine-R	Head-L	*AFFIX	ABUT-NEG	ECONOMY	Neg-in-FP	"V2"
I.	$[_S$ NP$_{su}$ $[_{VP}$ NP$_{oj}$ V-**NEG**]]	0	1	*!		7	*	
II.	$[_S$ NP$_{su}$ $[_{VP}$ **NEG**-V NP$_{oj}$]]	1!	0	*		7	*	
III. ☞	$[_S$ NP$_{su}$ $[_{VP}$ $[_{V^0}$ **NEG**^{0} V^0] NP$_{oj}$]]	0	1			8	*	
IV. ☞	$[_S$ NP$_{su}$ $[_{VP}$ NP$_{oj}$ $[_{V^0}$ V^0-COMP **NegV**^{0}]]]	0	1			8	*	
V.	$[_{FP}$ NP$_{su}$ $[_{F'}$ F^0 **NEG** $[_{VP}$ V NP$_{oj}$]]]	2!	0			8		
VI.	$[_{FP}$ NP$_{su}$ $[_{F'}$ F^0 $[_{VP}$ NP$_{oj}$ $[_{V'}$ **NEG** V]]]]	1	1!			8	*	
VII.	$[_{FP}$ NP$_{su}$ $[_{F'}$ F^0 **NEG** $[_{VP}$ V NP$_{oj}$]]]	2!	0			8		

In English (Type V), Neg-in-FP is ranked above Abut-Neg(V-HD) even though here, neither is violated and the ranking is therefore not significant. The ranking of these constraints as proposed becomes crucial in utterances like those in (38)–(39), where negation must appear before the parenthetical phrase that is presumably adjoined to VP.

(37) Type V: English (present perfect)

		Neg-in-FP	Head-L	ABUT-NEG	Spine-R	ECONOMY	*AFFIX	"V2"
I.	$[_S$ NP$_{su}$ $[_{VP}$ NP$_{oj}$ V-**NEG**]]	*!	1		0	7	*	
II.	$[_S$ NP$_{su}$ $[_{VP}$ **NEG**-V NP$_{oj}$]]	*!	0		1	7	*	
III.	$[_S$ NP$_{su}$ $[_{VP}$ $[_{V^0}$ **NEG**^{0} V^0] NP$_{oj}$]]	*!	1		0	8		
IV.	$[_S$ NP$_{su}$ $[_{VP}$ NP$_{oj}$ $[_{V^0}$ V^0-COMP **NegV**^{0}]]]	*!	1		0	8		
V. ☞	$[_{FP}$ NP$_{su}$ $[_{F'}$ F^0 **NEG** $[_{VP}$ V NP$_{oj}$]]]		0		2	8		
VI.	$[_{FP}$ NP$_{su}$ $[_{F'}$ F^0 $[_{VP}$ NP$_{oj}$ $[_{V'}$ **NEG** V]]]]	*!	1		1	8		
VII. (☞)	$[_{FP}$ NP$_{su}$ $[_{F'}$ F^0 **NEG** $[_{VP}$ V NP$_{oj}$]]]		0		2	8		

(38) a. John has **not**, $[_{VP}$ <u>in fact</u>, left the country].

b. ??John has, $[_{VP}$ <u>in fact</u>, **not** left the country].

(39) a. The meeting did **not**, $[_{VP}$ <u>however</u>, bring peace to the nation].

b. ??The meeting did, $[_{VP}$ <u>however</u>, **not** bring peace to the nation].

(40) Type V: German

		"V2"	*AFFIX	ECONOMY	Spine-R	Head-L	ABUT-NEG	Neg-in-FP
I.	[$_S$ NP$_{su}$ [$_{VP}$ NP$_{oj}$ V-**NEG**]]	*!	*	7	0	1		*
II.	[$_S$ NP$_{su}$ [$_{VP}$ **NEG**-V NP$_{oj}$]]	*!	*	7	1	0		*
III.	[$_S$ NP$_{su}$ [$_{VP}$ [$_{V^0}$ **NEG**^{0} V^0] NP$_{oj}$]]	*!		8	0	1		*
IV.	[$_S$ NP$_{su}$ [$_{VP}$ NP$_{oj}$ [$_{V^0}$ V^0-COMP **NegV**^{0}]]]	*!		8	0	1		*
V.	[$_{FP}$ NP$_{su}$ [$_{F'}$ F^0 **NEG** [$_{VP}$ V NP$_{oj}$]]]			8	2!	0		
VI. ☞	[$_{FP}$ NP$_{su}$ [$_{F'}$ F^0 [$_{VP}$ NP$_{oj}$ [$_{V'}$ **NEG** V]]]]			8	1	1		
VII.	[$_{FP}$ NP$_{su}$ [$_{F'}$ F^0 **NEG** [$_{VP}$ V NP$_{oj}$]]]			8	2!	1		

In German, the ranking of Spine-R above Head-L ensures the optimal candidate to be head-final, provided that the higher-ranked constraint "V2" is respected. *Affix and ECONOMY are also high-ranked, crucially dominating both Abut-Neg(V-HD) and Neg-in-FP. The ranking produces the result that in a main clause negation will appear inside VP and not be in I^0, next (or at least closer) to the inflected verb in V2 position—head of CP in German. For concreteness, consider the two structures in (41).

(41)

		ECONOMY
a.	[$_{CP}$ NP$_{subj}$ [$_{C'}$ V$_{fin}$ [$_{IP}$ [$_{I'}$ Neg^0 [$_{VP}$ NP$_{obj}$]]]]]	9 violations
b.	[$_{CP}$ NP$_{subj}$ [$_{C'}$ V$_{fin}$ [$_{VP}$ NP$_{obj}$ [$_{V'}$ Neg^0]]]]	8 violations

In the structure in (41a), the finite verb is in C and the negative particle in I. This configuration would satisfy both Abut-Neg and Neg-in-FP. The structure in (41b), on the other hand, violates both these constraints: the finite verb is in C, and negation is in head-adjoined position under V′. In terms of economy, however, the structure in (41a) violates the ECONOMY constraint more severely. For convenience, we simply count the nodes that are shown in the brackets for the violation of ECONOMY: CP, NP$_{subj}$, C′, V$_{fin}$, IP, I′, Neg^0, VP, and NP$_{obj}$—the total of nine violations. In (41b), on the other hand, there are eight violations: CP, NP$_{subj}$, C′, V$_{fin}$, VP, NP$_{obj}$, and Neg^0. The ranking of these constraints as proposed thus yields the earlier example, repeated here in (42).

(42) [$_{CP}$ Warum [$_{C'}$ gefiel [$_S$ [$_{NP}$ unsere Lösung] [$_{NP}$ dem Peter] [$_V$ **nicht**]]]]?
why pleased our solution Peter not
'Why did our solution not please Peter?' (Haegeman 1995:168)

The example is a *wh*-question, where the *wh*-element *warum* 'why' occupies SpecCP, and the finite verb *gefiel* 'pleased' in C^0. Neg^0 adjoined to V, although the V head appears in C. As pointed out earlier, there is also empirical evidence that German lacks IP. This is another reason to eliminate a structure like that in (41a) where negation would be the only lexical item to occupy I.

Again, an important generalization that emerges from these data is that negation is associated with Infl, and the most straightforward syntactic expression is to be in I or in the domain of IP (e.g. under I′). If the language in question lacks I (and IP), then negation will be associated with some other verbal category, typically V. In languages like Japanese that lack any functional categories or languages like Bantu in which there is only a handful of lexical items that appear in C and everything else (e.g. tense,

aspect, negation), both tense and negation are expressed as either suffixes or prefixes. For example in Japanese (and Turkish), both negation and tense are expressed as suffixes on the verb, as the earlier examples in (1)–(2) illustrate. In Bantu, both are expressed as prefixes, as illustrated earlier in (3). In Malagasy, illustrated earlier in (8), tense is expressed as a prefix on the verb, and negation is preverbal (expressed as a particle). These all point to the generalization that negation exhibits close affinity with tense (i.e. I or some other verbal category like V). Head-final languages where the sequence of functional elements and the main verb is V-I-C typically lack evidence for I or C, and negation is suffixal. In head-initial languages, the sequence of functional elements and the main verb is C-I-V. In languages like Bantu in which there is no evidence for Infl, negation is expressed as a prefix on the main verb along with tense; languages that exhibit IP (e.g. Swedish), the negative particle falls within the IP domain. In short, the form and placement of negation is generally predictable based on the presence/absence of I/IP and head-directionality.[6]

In Swedish, "V2" and Neg-in-FP are high-ranked. The ranking Head-L $\gg$ Spine-R yields head initial structure. As we saw in the tableau in (37), for present perfect clauses, either the ranking for English or the one for Swedish yields both their optimal candidates (V and VII). This is because even though English is not a V2 language, in present perfect, the auxiliary verb occupies I^0, rendering a V2-like structure and consequently satisfying the "V2" constraint as defined in (29a). These rankings, however, yield different results in simple past tense clauses and other clause types such as subordination and non-subject topicalization.

The tableau in (43) represents a Swedish simple past tense clause. Here we focus on Types V (English), VI (German), and VII (Swedish), as the others do not differ much from the earlier tableaux. Due to the absence of the V2 requirement and the ranking of *Lex-in-F above "V2" (not shown in the tableau) that bans a lexical head in functional head position, English employs *do* in simple past. This is interpreted as a violation of "V2". It is possible to interpret *do* as being a lexical head filling functional head position, but this is not a desirable interpretation because the function of *do* which is basically to host tense information in the absence of an auxiliary verb precisely in cases where there is no auxiliary element to fill the functional head position. In Swedish, due to the high-ranking "V2" constraint (above *Lexi-in-F), the finite verb fills F^0. An example of this optimal structure is given in (44) from Swedish (Sells 2000, ex(18c)).

(43) Main clause (simple past)

		"V2"	Neg-in-FP	Head-L	Spine-R	ECONOMY	ABUT-NEG	*AFFIX
V.	$[_{FP}$ NP$_{su}$ $[_{F'}$ DO **NEG** $[_{VP}$ V NP$_{oj}$]]]	*		0	2	10		
VI.	$[_{FP}$ NP$_{su}$ $[_{F'}$ V$_{fin}$ $[_{VP}$ NP$_{oj}$ **NEG**]]]]		*	0	1	9	*	
VII. ☞	$[_{FP}$ NP$_{su}$ $[_{F'}$ V$_{fin}$ **NEG** $[_{VP}$ NP$_{oj}$]]]			0	2	9		

(44) Jag gav **inte** Elsa någonting.
I gave not Elsa anything

[6]The OT-LFG approach to clause structure pursued here also makes a claim that the presence/absence of functional projections in a given language is predictable in part based on the head-directionality of that language, as discussed earlier in section 3.

This ranking also eliminates candidate VI, the optimal structure for German, in which negation is not in FP. It is important to note that in German Spine-R will be ranked above Head-L and Neg-in-FP, as we saw in the tableau in (40): "V2" … *Spine-R ≫ Head-L … Neg-in-FP. High-ranking Spine-R prefers the structure in VI over the one in VII: VI violates Spine-R only once, but VII, placing Neg under F′ along with the leftmost V-head, violates it twice. The interaction of these constraints presented here thus formally illustrates how the position of negation correlates with the presence/absence of I and head-directionality.

The tableau in (45) represents a subordinate clause in Swedish. Here I only consider the two V2 languages in which the position of the finite verb differs from that in a matrix clause. These illustrate essentially the same point as that in the preceding tableau in (43): the interaction of Neg-in-FP and Spine-R is crucial here. The data that confirms the result of the constraint interaction in (45) is provided in (46) from Swedish (Sells 2000, ex(3c)).

(45) Subordinate clause

		"V2"	Neg-in-FP	Head-L	Spine-R	ECONOMY	ABUT-NEG	*AFFIX
VI.	[$_{C'}$ Comp [$_{S}$ NP$_{su}$ [$_{VP}$ [$_{V'}$ NP$_{oj}$ **NEG** V]]]]	*	*	0	2	11		
VII. ☞	[$_{C'}$ Comp [$_{FP}$ NP$_{su}$ [$_{F'}$ **NEG** [$_{VP}$ V NP$_{oj}$]]]	*		0	3	11		

(46) … att jag **inte** [$_{VP}$ har gett boken till henne]
… that I not [$_{VP}$ have given the.book to her]

The tableau in (47) represents non-subject topicalization also in Swedish, again illustrating essentially the same point as the two preceding tableaux. Note additionally that in English, Abut-Neg ranks above Spine-R, and "V2" is low-ranked: Neg-FP ≫ Head-L ≫ Abut-Neg ≫ Spine-R ≫ … ≫ "V2" (cf. (37)). This ranking would yield the structure in V to be optimal in (47).

(47) Nonsubject initial clause (simple past)

		"V2"	Neg-in-FP	Head-L	Spine-R	ECONOMY	ABUT-NEG	*AFFIX
V.	[$_{IP}$ NP$_{top}$ [$_{IP}$ NP$_{subj}$ [$_{F'}$ DO **NEG** [$_{VP}$ V NP$_{obj}$]]]]	*		0	3	13		
VI.	[$_{CP}$ NP$_{top}$ [$_{C'}$ V$_{fin}$ [$_{S}$ NP$_{subj}$ [$_{VP}$ NP$_{obj}$ **Neg**]]]]]		*	0	1	13	*	
VII. ☞	[$_{CP}$ NP$_{top}$ [$_{C'}$ V$_{fin}$ [$_{IP}$ NP$_{subj}$ [$_{I'}$ **NEG** [$_{VP}$ NP$_{obj}$]]]]]			0	2	13	*	

5 Conclusion

This paper has aimed at providing insight into the following areas: from the formal perspective within OT-LFG, I have proposed an additional formal mechanism that enables us to derive directionality parameters by interacting with independently motivated constraints on clausal skeleton and head-positioning.

This contributes to the on-going development in OT-LFG clausal syntax, which attempts to integrate universal properties of phrase structure into formal theory of clausal syntax. The present analysis of a syntactic typology of negation demonstrates that directionality parameters can be derived without losing Kayne's insight that phrase structure is fundamentally antisymmetric or recourse to unmotivated movement operations.

From the theoretical perspective, in particular with respect to the syntax of negation, the present analysis makes a claim that both form and placement of negation in a given language are in part predictable based on the head-directionality and the presence/absence of I/IP of that language—the generalization that is difficult to capture without seriously taking into account universal markedness and typological tendencies in formal theory of clausal syntax.

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